Preface

The present two volume set focuses on the interface between physiologic mechanisms and diagnostic human engineering. A multitude of biomedical sensors are commonplace in clinical practice today. The registered biomedical signals, which will be referred to as biosignals, reflect vital physiologic phenomena and are relevant not only for the pre-screening and diagnosis of maladies but also for therapy and follow-up treatment. For instance, the diagnosis of sleep apnea, i.e., abnormal cessation of respiration during sleep, requires the monitoring of a complete set of sleep and respiratory variables with at least eight different sensors distributed over the entire body.

In order to adequately apply biomedical sensors and reasonably interpret the corresponding biosignals, a proper understanding of the physiologic phenomena involved, their influence on the registered biosignals, and the technology behind the sensors is critical. Moreover, a nearly unlimited diversity of biosignals emphasizes the need for a strategic approach in the genesis of biosignals, including a profound understanding of fundamentally different mechanisms in a biosignal's generation.

From a strategic point of view, biosignal generation involves the biosignal formation path from the biosignal source at the physiological level, to biosignal propagation in the body, to biosignal transmission in the sensor up to its conversion to a, usually electric, signal. To give an example, heart sounds, an acoustic biosignal, are created by the closure of heart valves, which constitutes the biosignal source. Sound attenuation in the thoracic tissue represents the propagation mechanism. Amplification and filtering of the heart sounds in the chestpiece (of the stethoscope) reflect biosignal transmission effects in the sensor, with biosignal conversion being performed by a microphone at the output of the chestpiece.

The first volume is focused on the interface between physiologic mechanisms and the resultant biosignals, whereas the second volume is devoted to the interface between biosignals and biomedical sensors. Unlike other contributions, this book deals differently on the subject of either specific physiologic mechanisms or specific engineering aspects pertaining to particular biomedical sensors, since it emphasizes the *interface* between them. Both volumes systematically describe basic mechanisms of biosignal formation while electric, acoustic, optic, and mechanic biosignals are considered in depth.

In the given volume, the physiologic mechanisms determining biosignals are described from the basic cellular level—as the place of origin of each and every biosignal—up to their advanced mutual coordination level, e.g., during sleep. It allows a physiologically accurate interpretation and comprehensive analysis of the biosignals. The resultant biosignals are discussed within the scope of vital and common physiologic phenomena to foster their understanding and comprehensive analysis.

This book is directed primarily at graduate and postgraduate students in biomedical engineering and biophysics. It should also appeal to those who are studying or are interested in physical, engineering, and life sciences, since expected background knowledge is minimal and many basic phenomena are explained in depth within the numerous footnotes. Furthermore, the book should serve engineers and practitioners who have an interest in aspects of biomedical engineering. This book attempts to provide a blinding glimpse of the obvious, in spite of the issues that appear rather complex at first glance.

It is important to note that this book was mainly inspired by my lectures entitled "Biomedical Sensors and Signals," "Biomedical Instrumentation," and "Biophysics" which constitute a significant part of a master's degree program "Biomedical Engineering" at the Vienna University of Technology.

Vienna, Austria *Eugenijus Kaniusas*

http://www.springer.com/978-3-642-24842-9

Biomedical Signals and Sensors I
Linking Physiological Phenomena and Biosignals
Kaniusas, E.
2012, XVIII, 298 p., Hardcover
ISBN: 978-3-642-24842-9